Sensorial traits, pH, losses, and dry matter recovery of elephantgrass silage with different proportions of cotton processing residue

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Introduction Elephantgrass is used on many cattle raising farms to be a strategic source of forage in the dry season of the year. In general, it is left to grow freely for just one cut, resulting in low forage quality, negatively affecting animal performance. Making silage seems to be the best way to conserve it. However its high moisture content and low amount of soluble carbohydrates limits the fermentation process. Dry additives have been added in elephantgrass ensiling to improve the pattern of fermentation (Quadros et al., 2001). The state of Bahia is the second largest producer of cotton in Brazil, releasing huge amounts of residue. The objectives of this work was to evaluate the sensorial traits, pH, gas and effluent losses, and dry matter (DM) recovery of elephantgrass silage with different proportions of cotton processing residue.

Materials and Methods The experiment was conducted at the Bahia State University, in Barreiras, BA, Brazil (12° 09' 10" S 44° 59' 24" W). Elephantgrass with 60 days of regrowth, with 20 % DM, was cut into average particle sizes of 3.0 mm, then it was stored exclusively or with 5, 10, 15, and 20% of cotton processing residue (fresh basis). There were used 25 plastic buckets, sized of 0.02 m^3, as experimental silos containing 4 kg of sand at the bottom, having 5 of them each treatment, following a completely random design. The grass and the residue were mixed conforming to each treatment and compacted using feet, reaching the density of 340 kg/m^3. After 50 days, the silos were weighted and opened, measuring gas and effluent losses by gravimetric evaluation. After that, pH was measured using Silva and Queiroz (2002) methodology. Samples of 200g were dried in forced air circulation ovens, with temperature regulated at 140ºF for 72 hours to determine DM content. Another three samples of 200 g were evaluated for sensorial traits, by 3 person, using the Meyer et al. (1989) scale. Data was analyzed using ASSISTAT, assuming that significant differences among average values when P values were fewer than 5%. Furthermore, data was analyzed by orthogonal polynomials, verifying the linear, quadratic, or cubic effects, and the significance degree.

Results and discussion The DM content increased linearly ($P<0.01$) with the increasing of the proportions of cotton residue, from 18.4 % in the exclusive elephantgrass silage to 31.6 % with 20 % residue. The pH was higher ($P<0.01$) in the silages with 10, 15, and 20 % of cotton residue in comparison to 0 and 5 %, instead of what was the observed by Quadros et al. (2003) when adding from 5 to 20 % coffee hulls to elephantgrass silage. The ideal pH for good silage starts at 3.8 to 4.2 (McDonald et al., 1991). According to these authors, grass silage dry matter contents of 20 % are normally accepted as a lower limit to decrease pH close to 4.0 and then preserve ensiled herbage satisfactorily. However, when herbage is too wet, even lowering its pH to 4.0 would not be enough to inhibit clostridial growth. The interaction between pH and the DM should also be considered to control undesirable silage fermentation (Quadros et al, 2003). The effluent losses dropped with the inclusion of cotton residue ($P<0.01$) (Table 1). On the other hand, gas losses did not follow a defined pattern with the increasing of cotton residue, affecting the results of total losses and DM recovery. The worth result was obtained with 20 % of residue, compared with 0, 5, and 15 %, while with 10% did not differ among them ($P>0.05$). The sensorial traits, divided in

characteristics and sanity, was an easy way to evaluate silages in the field. The characteristics of silage were better using 20% cotton residue (P<0.05) than the exclusive elephantgrass, while with 5, 10, and 15% of residue did not differ among them (P>0.05) (Table 1). The score, according to Meyer et al. (1989), below or equal to 15 indicates non satisfying silage, 16 to 19 regular, 20 to 25 satisfying, 26 to 30 good to very good.

Conclusion The inclusion of cotton residue can be recommended to increase both the sensorial traits and DM content, and reduce effluent losses. The higher pH seems to not have affected the silage fermentation pattern. The extension of gas losses needs to be studied further.

References

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Table 1. Sensorial traits, DM content, pH and losses in the elephantgrass silage with different proportions of cotton residue

Variables	Cotton residue proportion					SEM[1]	Effect
	0%	5%	10%	15%	20%		
DM (%)	18.4^{d}	22.9^{cd}	26.5^{bc}	30.5^{ab}	31.6^{a}	4.71	Linear**
pH	4.01^{b}	4.10^{b}	4.37^{a}	4.49^{a}	4.45^{a}	0.18	Quadratic*
Losses by effluent (kg/ton)	51.6^{a}	4.49^{b}	2.67^{b}	3.50^{b}	1.76^{b}	4.45	Linear**
Losses by gas (%)	1.09^{b}	1.01^{b}	1.83^{ab}	1.52^{b}	2.90^{a}	1.10	NS
DM recovery (%)	89.1^{a}	89.9^{a}	81.7^{ab}	84.8^{a}	71.0^{b}	11.0	NS
Total DM losses (%)	15.6^{b}	10.5^{b}	18.5^{ab}	15.5^{b}	29.2^{a}	10.9	NS
Sensorial traits							
Characteristic	15.0^{b}	21.5^{ab}	21.4^{ab}	21.0^{ab}	25.3^{a}	6.90	Cubic*
Sanity	-0.53^{a}	-0.53^{a}	-2.93^{a}	-1.80^{a}	-1.60^{a}	3.84	NS

[a–d]Means within a row with different superscripts differ ($P < 0.05$).

[2]SEM = standard error of the mean. NS $P > 0.05$; *$P < 0.05$; **$P < 0.01$.